Section 2

Overview of Site Characterization Activities Performed

Characterizing the site is a key element of the RI/FS process. Site characterization includes reviewing data available for the site, performing additional data collection, evaluating the data to describe the site and to develop the BHHRA, and determining if the data are sufficient for developing and evaluating potential remedial alternatives (**EPA, 1988**).

This section provides an overview of the site characterization activities performed to complete the RI/FS for the GWP site. The discussion of activities includes an overview of the data collection objectives (referred to as DQOs), and a general description of the site characterization tasks completed in accordance with the site plans. The discussion also includes an overview of the field procedures followed for the collection of soil vapor and ground water data, and the management of IDW.

2.1 Data Quality Objectives

DQOs are qualitative and/or quantitative statements that provide a basis for the identification of the RI/FS data collection activities. DQOs help ensure that data collected during the RI/FS is of sufficient and adequate quality for their intended use. The TAWPs prepared for each mobilization during performance of the RI developed and presented site-specific DQOs to identify and describe the type and quality of the data needed to support future decisions regarding remedial actions at the GWP site (**CH2M HILL, 2002a**, **CH2M HILL, 2002e**, and **CH2M HILL, 2005a**). The EPA guidance describes a seven-step process that provides a systematic approach for defining the criteria to be met in the data collection effort (**EPA, 2000a**).

The first step in the process is to identify the problem. The following problem statements, in the form of questions, represent the original objectives of the RI data collection activities for the completion of the RI/FS:

1. Is (are) the primary source(s) of PCE contamination in soil vapor and ground water still present and acting as a continuing source(s)?

2. Is (are) secondary source(s) of PCE in soil and or ground water still present and acting as a continuing source(s)?
3. What is the vertical and horizontal extent and magnitude of PCE contamination in soil, soil vapor, and ground water, relative to potential receptors?
4. Is the contamination detected at CLC Well No. 24 related to the contamination demonstrated at the GWP Site (i.e. CLC Well Nos. 18, 19, 21, 27)?
5. Do the affected soil, soil vapor, and/or ground water pose an unacceptable risk to human health or the environment?
6. If a risk is confirmed, where do the contaminant concentrations exceed applicable or relevant and appropriate requirements (ARARs) or exceed contaminant concentrations corresponding to preliminary remediation goals that may be established for the site?
7. What remedial alternatives are appropriate to address the contamination at the site, in light of the risk to receptors?

These problem statements were presented in the TAWP Version 1.3 (**CH2M HILL, 2002a**), and guided the data collection efforts in the first mobilization, performed in 2002.

Based on the data collected in the first mobilization, the following problem statements were developed to design field activities for the completion of the RI/FS (in the second mobilization, performed in 2005):

1. Determine the magnitude and extent of PCE in ground water sufficient to perform an evaluation of risk and an evaluation of remedial alternatives;
2. Determine the relation between soil vapor contamination and contamination in the ground water in the identified source area at the DACTD maintenance facility and whether the soil vapor is acting as a continual source of ground water contamination;
3. Determine the impact of PCE in shallow soil vapor to indoor air quality in the residential neighborhood northeast of the intersection of Hadley Avenue and Walnut Street, at the Meerscheidt Recreational Center, and at the Police Athletic League (PAL) Boxing Facility;
4. Collect information regarding chemical and physical properties of the aquifer sufficient to support evaluation of fate and transport of the PCE contamination and remedial alternatives; and,
5. Identify the presence of additional private wells in the vicinity of the plume and not identified during previous field activities that could be potential exposure routes.

Based on these problem statements, the RI/FS team specifically identified the decisions to be made, the applicable inputs to these decisions, defined the investigation boundary, developed a decision rule, specified limits of decision errors, and optimized the sampling design. The TAWP documents developed for each field mobilization provide a detailed description of this process (**CH2M HILL, 2002a**, **CH2M HILL, 2002e**, and **CH2M HILL, 2005a**). The resulting DQOs identified for the GWP site are listed in **Table 2-1**. These DQOs describe the data to be collected for completion of the RI/FS.

2.2 Field Investigation Activities

The following paragraphs summarize the RI field activities. **Tables 2-2a, 2-2b,** and **2-2c** provide a list of the number and type of each sample collected during the field investigation (in 2002, 2004, and 2005, respectively). The text refers the reader to **Appendix B** for a more detailed description of the field procedures, **Appendix C** for analytical Chain of Custody (COC) forms and analytical results, **Appendix D** for soil boring logs, geophysical logs, and monitor well and SVMP construction diagrams, **Appendix E** for water quality data, **Appendix F** for sample location coordinates, **Appendix G** for the Data Quality Evaluation (DQE), and **Appendix H** for water level data.

2.2.1 First Mobilization

At the time the site was added to the NPL in June 2001, EPA initiated the RI as the first step in the RI/FS process. The fieldwork for the first mobilization effort for the RI occurred from April 2002 through February 2003. EPA also used the data collected to identify areas where PCE was likely to have been released at the site. This first field mobilization included the collection of over 600 soil vapor samples, the installation of 7 deep SVMPs, the installation of 8 multi-port ground water monitor wells, and the collection of over 200 ground water samples from new and existing monitor wells. **Figure 2-1** illustrates the locations of soil vapor and ground water samples collected during this first field mobilization. **Table 2-2a** provides a list of the number and type of each sample collected during this first field mobilization. A detailed discussion of the results from this first field mobilization is provided in the IDRA Report (**EPA, 2003a**), and a detailed discussion of the field activities completed during the first field mobilization is provided in **Appendix B**.

Two-hundred and forty soil vapor borings were completed during the first mobilization. In each boring, soil vapor samples were collected at depths ranging between 5 and 50 ft bgs. The field team analyzed these samples for chlorinated VOCs in each boring using an onsite mobile laboratory. The use of the mobile laboratory provided rapid turn-around of the samples collected. This method assisted in allowing the field team to assess quickly the subsequent sampling locations by targeting areas needing further evaluation. Of the compounds analyzed, only PCE and trichloroethylene (TCE) were detected in the soil vapor. PCE was detected at one or more depths and in 193 of the 240 soil vapor borings completed (i.e. in 80 percent of the borings). PCE concentrations detected in the soil vapor borings ranged from 0.06 (B) µg/L to 28.9 µg/L. The "B" lab qualifier indicates that the analytical result was greater than the method detection limit (MDL) but less than the practical quantitation limit (PQL).

Soil vapor samples were also collected at depths ranging from 12 to 115 ft bgs from the seven SVMPs. PCE was detected at six of the seven SVMP locations. The range of PCE concentrations detected was 0.07 (B) to 7.83 µg/L. PCE was the only chlorinated VOC detected in samples collected from the SVMP locations.

Eight multi-port ground water monitor wells were installed during the first mobilization. In December 2002, ground water samples were collected from the eight multi-port monitor wells and 15 existing water table monitor wells installed previously by NMED. In the Upper Hydrologic Zone (UHZ), PCE was detected at concentrations ranging from 0.69 to 38 µg/L. In the Lower Hydrologic Zone (LHZ), PCE was detected at concentrations ranging from 0.31 to 53 µg/L. The site geology and hydrogeology, including descriptions of the UHZ and LHZ, are discussed in detail in **Sections 3.6.2** and **3.7.2**.

Based on data collected at the site during EPA's first mobilization, described in further detail in the IDRA Report, EPA identified areas where PCE was released to the environment and resulted in contamination of soil vapor and ground water. The IDRA Report concluded that the PCE was released to the surface soil and migrated to ground water over time (**EPA, 2003**). The locations of the current and historical land uses that correspond with the locations of higher relative concentrations of PCE in soil vapor are illustrated in **Figure 2-2**. These land uses are the historical operations at the Former National Guard Armory, historical operations at the former Crawford Municipal Airport, suspected historical uncontrolled dumping of waste materials west of North Walnut Street along the former arroyo area parallel to and south of the former airport runway (on the same property as the former Crawford Municipal Airport), and historical and/or current operations at the DACTD maintenance facility. For more detail on the identification and screening of potential sources of PCE in soil vapor, refer to the IDRA Report (**EPA, 2003a**).

In January 2004, EPA collected an additional round of ground water data from site monitor wells. The objective for collecting these data was to obtain a comprehensive set of analytical results for evaluating any changes that could have occurred in the plume, based on past data collected by EPA and NMED, and to refine the plume boundaries. This sampling event included a comprehensive collection of samples for the full suite of organic and inorganic constituents commonly analyzed under CERCLA. The samples were analyzed through EPA's Contract Laboratory Program (CLP). The CLP laboratory analyzed the samples collected from the multi-port monitor wells for Target Compound List (TCL) VOCs, TCL semi-volatile organic compounds (SVOCs), TCL pesticides and polychlorinated biphenyls (PCBs), Target Analyte List (TAL) metals, and mercury. At EPA's request, the CLP laboratory analyzed the samples collected from water table monitor wells for TCL VOCs only, because of the limited sample volume available from these wells.

Based on the results from this sampling event, EPA concluded that the PCE plume appeared to be stable in size relative to the plume size determined from data collected since July 2000. The plume did not appear to be significantly increasing or decreasing in size, and the extent of the plume was well defined horizontally in most areas. Two areas where the plume was not completely defined laterally were (1) northwest of monitor well GWMW06 and (2) east of I-25. For a description of the other organic and inorganic constituents detected in this sampling event, refer to the January 2004 sampling event technical memorandum (**CH2M HILL, 2004**).

2.2.2 Second Mobilization

The second RI field mobilization was performed during October through December 2005. Its intended goal was to address the remaining data needs identified by the first mobilization for completing the RI/FS. **Table 2-3** lists historical detections of PCE in vicinity monitor wells (through December 2005). **Figure 2-3** shows the historical detections of PCE in site monitor wells from 1998 through the most recent sampling event in December 2005.

The second mobilization tasks included a private well search, and field activities including the installation of two additional monitor wells, installation of one additional deep SVMP, collection of additional shallow subsurface soil vapor samples to support completion of the BHHRA, and collection of ground water samples in new and existing monitor wells. Detailed plans for implementation of these tasks are described in the TAWP (**CH2M HILL, 2005a**), which describes the DQOs and an overview of the investigation tasks, FSP (**CH2M HILL, 2005b**), QAPP (**CH2M HILL, 2005c**), and SMP (**CH2M HILL, 2005d**).

2.2.2.1 Private Water Supply Well Search

As part of the second mobilization, a data search was initiated to identify and locate private water supply wells within a one-half mile radius of the GWP site plume. This activity was performed to address DQO Problem Statement No. 5 for the second mobilization. To identify these wells, information available from the New Mexico Office of the State Engineer (NMOSE) was reviewed.

The NMOSE is charged with administering the state's water resources, and as part of that charge, issues permits to qualified applicants to drill and use a well in accordance with New Mexico Statutes Annotated (NMSA) Section 72-12-1. Ground water wells are thereby registered and listed in the Water Administration Technical Engineering Resource System (WATERS) database, available through the NMOSE's website (http://www.ose.state.nm.us/waters_db_index.html). The system provides a historical analysis of each individual water right claim in New Mexico, court orders and decrees, hydrographic survey results, water right applications pending before the State Engineer, and electronic images of water right documents.

In 2000, the NMOSE performed a hydrographic survey of the Mesilla Valley Section of the Lower Rio Grande Basin. The hydrographic survey included efforts to identify and locate wells that were installed prior to declaration of the ground water basin (September 11, 1980), and as a result might not have been permitted through the NMOSE at the time of installation. The hydrographic survey report includes information for permitted and identified un-permitted wells located near the GWP site up to 2000 (**NMOSE, 2000**).

To identify private wells in the vicinity of the GWP site, the NMOSE's database of permitted wells and the NMOSE hydrographic survey were reviewed. Five private wells were identified within a one-half mile radius of the GWP site. A separate search performed by the CLC confirmed these results (**JSAI, 2005**).

The five wells located within a one-half mile radius of the GWP site are private wells 111060A and 111061A, also known as LRG-3191 (located near GWMW07), and private wells 111003A, 111004A, and 101130A (located north and west of CLC Well No. 10). The stated purpose of use for each of these five wells in the hydrographic survey report is for domestic purposes (**NMOSE, 2000**).

Two wells located near CLC Well No. 24 to the south of the GWP site were also identified. These are previously-identified irrigation well LRG-1457, located at Lynn Middle School, and private well 111080A, located south of Lynn Middle School. The stated purpose for private well 111080A is domestic use. Well LRG-1457 is permitted as an irrigation well (**NMOSE, 2000**). **Figure 2-4** illustrates the approximate locations of these seven wells relative to the GWP site.

Private wells were not found within the plume boundary or immediately downgradient. One private well identified previously by NMED during GWP site investigations is no longer present, and is not included in the current list of wells. This is well LRG-7375, formerly located on the east side of I-25, north of Lohman Avenue.

The following paragraphs discuss each group of currently identified wells in greater detail.

Wells near GWMW07. Two of the private wells were identified near existing site monitor well GWMW07. One (known as LRG-3191 and recorded as 111061A in the hydrographic survey) was previously identified by NMED as part of GWP site investigations and has been sampled for PCE in the past (results are listed in **Table 1-2**). The owner reported in December 2005 that they use the well primarily for irrigation, although they may occasionally drink from the hose. The second well (111060A) is located just north of and across the street from LRG-3191 in a vacant lot. This well had not been identified previously as part of GWP site investigations. The owner indicated that no one has used this well since 1979. Prior to 1979, the owner used the well for irrigating a garden on the property. There is no house on this property. Because this well is not in use, samples were not collected at this location in the most recent sampling event (December 2005).

Wells near CLC Well No. 10. The other three private wells are located north and east of CLC Well No. 10. One well (101130A) is located approximately 1,400 ft northwest of CLC10 and the other two wells are located approximately 1,400 ft (well 111004A) and 3,400 ft (111003A) north-northeast of CLC10. These three wells are located hydraulically upgradient of the GWP plume, and were therefore not sampled in the most recent sampling event (December 2005).

Wells near CLC Well No. 24. Using the hydrographic survey, the field team identified two private wells near CLC Well No. 24. One is the irrigation well located at Lynn Middle School (LRG-1457). LRG-1457 is located approximately one-half mile south of and cross gradient to the plume boundary. The school used this well in the past as an irrigation well. Currently this well is inoperable because of a mechanical problem with the pump, and therefore was not sampled during the most recent sampling event (December 2005). Private well 111080A is located at 1952 Klein Avenue, about two blocks south of the school. Because of this well's location cross gradient to the GWP site plume, it was not sampled in the most recent sampling event (December 2005).

2.2.2.2 Soil Vapor Investigation Activities

Soil vapor sampling was performed to address the potential for soil vapor intrusion to indoor space as a potential exposure route for PCE and the relation of PCE in soil vapor to ground water contamination. To address Problem Statement No. 3 for the second mobilization, shallow soil vapor was sampled to evaluate the impact of PCE in shallow soil vapor to indoor air quality in the residential neighborhood northeast of the intersection of Hadley Avenue and Walnut Street, at the

Meerscheidt Recreational Center, and at the PAL Boxing Facility. To address Problem Statement No. 2 for the second mobilization, deep soil vapor was sampled to evaluate the relation between soil vapor contamination and contamination in the ground water in the identified source area at the DACTD maintenance facility and to evaluate whether the soil vapor is acting as a continual source of ground water contamination. Each of these activities is described in the following paragraphs.

2.2.2.2.1 Shallow Soil Vapor Intrusion Evaluation Sampling

A preliminary screening of the data collected during the first field mobilization indicated that the shallow PCE soil vapor contamination potentially posed an unacceptable risk to human health through vapor intrusion into buildings from several locations. **Figure 2-5** shows a conceptual illustration of how vapor contamination migrates into indoor air in buildings. Shallow soil vapor data were collected to quantify this potential risk to human health. The areas investigated included the residential neighborhood northeast of the intersection of Hadley Avenue and Walnut Street, the Meerscheidt Recreation Center (located at 1600 East Hadley Avenue), and the PAL Boxing Facility (located at 700 North Solano Drive). **Figure 2-6** illustrates the locations of these areas. **Table 2-2c** lists details regarding each sample, including location, depth, date sampled, sample type, and analytical method. The sample collection was in accordance with the procedures described in the site plans (**CH2M HILL, 2005b**, and **CH2M HILL, 2005c**).

Soil vapor samples were collected at thirty-four locations during the second field mobilization. Twenty-four locations were sampled in the residential neighborhood. Six locations were sampled at the Meerscheidt Recreation Center, and four locations were sampled at the PAL Boxing Facility.

A field portable gas chromatograph (GC) was used to analyze the shallow subsurface soil vapor samples for PCE and TCE. At each sample location, a soil vapor sample was collected from a depth of 5 ft and 10 ft bgs, or at the depth of refusal (whichever occurred first). Quality assurance/quality control (QA/QC) samples also were collected at a subset of the locations. The QA/QC samples were shipped to an offsite laboratory for analysis of VOCs via EPA Method TO-15.

In the residential neighborhood, soil vapor samples were collected initially at 10 locations. In accordance with the FSP, the field team compared the concentrations of PCE detected to the screening level set for this work (120 ppbv), and calculated the 95% upper confidence limit (UCL). The screening level was set to correspond with a residential indoor air inhalation risk of 1×10^{-6}. The goal was to determine if any single result or the 95% UCL of the PCE concentrations exceeded the screening level (120 ppbv). It was determined that most of the PCE analytical results individually exceeded the screening level and yielded a 95% UCL above 120 ppbv. In accordance with the site plans, and because the screening level had been exceeded, samples were collected at an additional 14 locations in the residential area.

With respect to vapor concentration units, the onsite mobile laboratory used during the first field mobilization reported vapor concentrations in units of µg/L (vapor). During the second mobilization, vapor concentrations from both the field GC and offsite laboratory were reported in units of ppbv. Vapor concentrations reported in units of µg/L can be converted to units of ppbv using the following formula:

> ppbv = µg/L x 1,000 x (24.04/MW) at 20 degrees Centigrade (ºC).
>
> where: ppbv is the vapor concentration in units of parts per billion by volume, µg/L is the concentration in soil vapor in units of micrograms of PCE per liter of vapor, 24.04 represents the molar volume of a gas at 20 ºC, and MW is the molecular weight (for PCE, the molecular weight is 166 grams per mole).

In this RI Report, the vapor concentration units originally reported by the analytical laboratory are used where possible. Where the results from both mobilizations are discussed, the vapor concentration units from the first field mobilization are usually converted to ppbv for purposes of consistency.

While the sampling activity was underway, preliminary risk calculations were performed at each location to determine if collection of additional samples would be necessary, or if sufficient information was available for decision makers to evaluate. The preliminary results indicated that the risk values calculated at the residential properties were within EPA's acceptable risk ranges. The preliminary findings were then presented to the Technical Work Group. The Work Group concluded that, pending review of the final evaluation of the risk assessment in this RI Report, the data collection activities met the DQOs.

Specific details describing the shallow soil vapor sampling activities are provided in **Appendix B**. COC was maintained for each sample sent to the offsite laboratory at all times and the handling steps are logged on the COC forms. **Appendix C** includes copies of all COCs for the second mobilization of the RI field investigation. Analytical results are provided in **Appendix C** and discussed in **Section 4.1.1.1**. The shallow soil vapor intrusion risk evaluation conducted with the data collected is summarized in **Section 7**, and described in detail in **Appendix A**.

2.2.2.2.2 Deep Soil Vapor Sampling

Data collected during the first mobilization indicated that PCE in soil vapor was likely to be contributing contamination to the ground water at the identified source areas. Seven permanent SVMPs were installed during the first mobilization to evaluate PCE concentrations in the soil vapor at depth. These SVMPs were installed using Direct-Push Technology (DPT). At SVMP locations east of SVMP03, however, DPT was unable to attain depths down to the water table. To evaluate the relation between PCE contamination in soil vapor and the ground water contamination at the DACTD maintenance facility, a permanent SVMP (designated SVMP16) was installed to the water table using the hollow-stem auger (HSA) drilling method. Soil vapor samples were then collected from the newly installed SVMP and two existing SVMPs (SVMP01, also located at the DACTD maintenance facility, and SVMP03, located at the Former National Guard Armory). **Figure 2-7** shows the locations of the new and existing SVMPs.

2.2.2.2.3 Soil Vapor Monitor Point Installation

The installation procedure for SVMP16 involved the completion of a boring, the installation of soil vapor implants, and the installation of annular materials. **Table 2-4** provides construction details for each new and existing SVMP. **Appendix B** presents a detailed description of SVMP installation procedures. The onsite geologist recorded lithologic information from the soil core on a soil boring log. **Appendix D** provides copies of the completed soil boring logs. Construction diagrams for each SVMP at the site are included in **Appendix D**.

2.2.2.2.4 Soil Vapor Monitor Point Sampling

Soil vapor samples were collected from the new (SVMP16) and two existing SVMPs (SVMP01 and SVMP03). **Table 2-2c** provides details regarding all samples collected (including depths sampled, dates of sample collection, sample types, and analytical methods). **Appendix B** includes a detailed description of the sampling procedures for SVMPs. COC was maintained for each sample sent to the offsite laboratory at all times and the handling steps are logged on the COC forms. **Appendix C** provides copies of COCs for each sample sent to the offsite laboratory and all analytical results. The analytical results are discussed in **Section 4.1.1.2**.

During sampling of the existing SVMPs (SVMP01 and SVMP03), a high purge vacuum developed in several of the monitor points. The high vacuum was most likely the result of clogged or crimped tubing. Because of the high purge vacuum, samples were not collected from the 80 ft bgs monitor point at SVMP01, the 48 ft bgs monitor point at SVMP03, or the 68 ft bgs monitor point at SVMP03. At SVMP03, a high purge vacuum was also noted in the 108 ft bgs monitor point. At this point, a sample was collected and analyzed using the portable GC; however, the DQE concluded the result was not valid and therefore unacceptable. At SVMP01, the sample tubing was very weathered and brittle. Three of the five sample tubes had broken off below the label identifying the monitor point depth; the field team matched the broken ends of the tubing with the portion that remained in place using the markings on the side of the tubing. The monitor point depths in question were 20 ft bgs, 40 ft bgs, and 60 ft bgs.

Initial sampling results from SVMP16 indicated that the SVMP had not yet reestablished equilibrium conditions after installation. The PCE results obtained from each monitor point were lower than anticipated and the results from each sample depth were similar to each other. In addition, sampling at the 175 ft bgs depth using longer purge times yielded increasing PCE concentrations with increased purge times. On December 2, 2005, two samples were collected from the 155 ft bgs depth to determine if the SVMP had reached equilibrium using increasing purge times. The results indicated that the SVMP was closer to, but not yet at, equilibrium. A final sampling of the 10 monitor points at SVMP16 was performed on December 27, 2005. Additional details regarding the additional sampling required at SVMP16, along with the analytical results, are contained in **Appendix B**.

2.2.2.3 Ground Water Monitor Well Installation Activities

Ground water monitor wells were installed to address Problem Statement No. 1 for the second mobilization, specifically to evaluate the extent of the PCE plume in relation to detections of PCE observed to the south and the extent of the PCE plume east of affected CLC Well Nos. 19 and 21. The new wells installed during the RI were designated GWMW11 and GWMW15. **Figure 2-8** illustrates the locations of new and existing monitor wells. **Table 2-4** provides a summary of the well construction details for the new and existing monitor wells at the site.

Monitor well GWMW11 was installed on Willow Street north of the intersection with Wendale Avenue. This well was installed south of the DACTD maintenance facility to verify the extent of the GWP site plume in relation to PCE detections observed to the south (in shallow soil vapor samples collected near Comet Cleaners and in ground water collected from CLC Well No. 24 and LRG-1457).

Monitor well GWMW15 was installed at the west base of the Las Cruces Flood Control Dam, approximately halfway between CLC Well Nos. 19 and 21. This well was installed to verify the extent of the plume east of the affected municipal supply wells and to evaluate the effectiveness of capture depending on the remedial alternative selected.

At each location, nested monitor wells composed of three individual wells installed in a single borehole were constructed. The nested wells at each location were designated -S, -I, or -D for shallow, intermediate, or deep, respectively.

Appendix B provides further detail regarding the monitor well drilling, installation, and well development procedures. **Appendix D** includes copies of soil boring logs and well construction diagrams. Coordinates for the location of each well are included in **Appendix F**.

2.2.2.4 Ground Water Sampling Activities

At the end of the monitor well installation activity during the second field mobilization, a single ground water sampling event occurred during December 5 through December 16, 2005. The ground water samples were collected to address second mobilization Problem Statement Nos. 1 and 4. The samples were collected to determine the current concentrations of PCE in wells. Samples were also collected to provide information relevant to the general chemical properties of the aquifer, sufficient to support an evaluation of fate and transport of the PCE contamination. Water level measurements were collected from all new and existing site monitor wells. Passive diffusion bag (PDB) samplers were installed in the water table monitor wells. The field team subsequently collected ground water samples from new and existing site monitor wells, selected CLC municipal supply wells, and identified private wells (**CH2M HILL, 2005b**). Samples were collected at all new and existing wells in December 2005, with the following exceptions:

- Water table monitor well CK-8 was dry and could not be sampled.
- Monitor well MW-6 contained only 6 inches of water in the well, which was insufficient for placement of the PDB.
- Private well LRG-1457 was not sampled because the school district had removed the pump equipment because of mechanical problems.
- CLC Well No. 19 could not be sampled because of mechanical problems with the well.
- CLC Well No. 27 could not be sampled because the discharge line from the well was broken.
- Private well 111080A was not sampled because of its location cross gradient to and south of the GWP site.
- Private wells 111025A, 101130A, and 111004A were not sampled because of their location upgradient of CLC Well No. 10.
- Private well 111060A was not sampled because (per property owner verification) the well had not been operated since 1979.

Figure 2-8 illustrates the locations of new and existing monitor wells. **Table 2-2c** provides details regarding all samples collected (including depths sampled, dates of sample collection, sample types, and analytical methods). **Appendix B** includes a detailed description of the ground water sampling procedures. An overview of the activities performed is provided in the following paragraphs.

Water levels were measured from November 29 through December 1, 2005. On November 29, 2005, water levels were measured in the water table monitor wells concurrent with the placement of PDBs in those wells. Water levels in the multi-port monitor wells and the new nested monitor wells were measured on November 30 and December 1, 2005. **Appendix H** presents the water level data.

Ground water samples were collected from the multi-port monitor wells (GWMW01-10) the week of December 5, 2005. These wells were sampled with the dedicated equipment provided by the manufacturer of the sampling systems installed in the wells. Each well port was purged three times prior to sample collection. During each purge cycle, general water quality parameters were recorded in the field logbook. Each multi-port well was sampled for TCL VOCs. Selected ports were sampled for additional parameters including nitrate/nitrite, dissolved gases (methane, ethane, and ethene), alkalinity, total organic carbon (TOC), hardness, sulfate, sulfide, chloride, total dissolved solids (TDS), dissolved oxygen (DO), ferrous iron, and dissolved manganese. The additional parameters were collected to provide general water chemistry data in the aquifer and to evaluate the potential for natural attenuation of the contamination via biodegradation.

Ground water samples were collected from the nested and water table monitor wells (MW wells, GWMW11, and GWMW15) the week of December 12, 2005. The field team extracted and collected samples from each PDB in the water table monitor wells (MW wells). At six of the water table wells, the low-flow purge method was used to collect QA/QC samples for comparison to the PDB results. The comparison of results and recommendations for consideration should PDBs be used at the site in the future are described as part of the DQE in **Appendix G-2**.

Ground water samples were collected from the six new nested wells (GWMW11-S, -I, -D, and GWMW15-S, -I, -D) using the low flow purge method the week of December 12, 2005. During purging, general water quality parameters were recorded on well purge and sampling field data sheets (provided in **Appendix E**). Each monitor well was purged until the water quality parameters had stabilized or until three well volumes had been removed from the well. A ground water sample was collected from each well following purging.

Samples from each monitor well were sent to the CLP laboratory for analysis of TCL VOCs. Additional samples were collected at selected monitor wells for analysis of nitrate/nitrite, dissolved gases, alkalinity, TOC, hardness, sulfate, sulfide, chloride, TDS, DO, ferrous iron, and dissolved manganese. The nitrate/nitrite and dissolved gas samples were submitted to an offsite subcontracted laboratory for analysis. DO, ferrous iron, and dissolved manganese were analyzed in the field using field test kits. The remaining samples were submitted to EPA's Houston laboratory for analysis.

Ground water samples were collected from the CLC municipal supply wells and private well LRG-3191 the week of December 12, 2005. The CLC wells and LRG-3191 were purged of three well volumes prior to sample collection. Water levels, well construction, and pumping rate information were obtained from the CLC to determine the purge volume and time to purge adequately the CLC wells. Well construction and pumping rate information was obtained from the LRG-3191 owner. This information and the water level measured in nearby multi-port monitor well GWMW07 port 1 was used to estimate the purge volume in LRG-3191. Samples from each CLC well and LRG-3191 were sent to the CLP laboratory for analysis of TCL VOCs.

Specific details describing the ground water sampling activities are provided in **Appendix B**. COC for each sample sent to the offsite laboratory was maintained at all times and the handling steps are logged on the COC forms. **Appendix C** includes copies of all COCs for the second mobilization of the RI field investigation. Analytical results are provided in **Appendix C** and discussed in **Sections 3** and **4**.

2.2.2.5 Surveying of Sample Locations

A Registered Public Land Surveyor in the State of New Mexico surveyed the locations of the new monitor wells GWMW11 and GWMW15 and the new SVMP16. Each location was surveyed to the nearest 0.01 ft to provide vertical and horizontal location control. The field team surveyed the shallow soil vapor sample locations using a hand-held Global Positioning System (GPS) unit to establish vertical and horizontal location control. The GPS unit was a Trimble GeoTX that provides sub-meter accuracy after data have been post processed. **Table 2-4** includes the survey data for the new and existing site monitor wells and SVMPs. **Appendix F** provides the coordinates for each sample location.

2.2.2.6 Management of Investigation-Derived Waste

The field investigation activities resulted in the generation of both soil and liquid IDW. This IDW was managed in accordance with site plans, as described in the following paragraphs.

Liquid IDW included drilling mud, decontamination fluids, development water, and purge water. With the permission of the CLC, liquid IDW that was free of sediments was disposed of directly to the sanitary sewer at CLC Well No. 18. With the permission of the CLC, liquid IDW that was sediment laden was contained onsite and subsequently transported to the CLC wastewater treatment facility by vacuum truck.

With the permission of the DAC, IDW soils were contained in roll-off containers at the DACTD maintenance facility pending testing. The field team collected samples of the IDW soil to determine whether it qualified as a hazardous waste using the Toxicity Characteristic Leaching Procedure (TCLP). At the field team's request, the laboratory analyzed the extracts for total VOCs, SVOCs, and metals. The field team also collected samples of the IDW soil for Total Petroleum Hydrocarbons – Gasoline Range Organics (TPH-GRO) and TPH – Diesel Range Organics (TPH-DRO). The field team submitted the IDW soil samples to an offsite laboratory for analysis. The results indicated the IDW soil did not qualify as a hazardous waste, and it was subsequently disposed at the RHINO Environmental Landfill in Chaparral, New Mexico.

Table 2-2c includes a list of the number and type of IDW soil samples collected during the field investigation. **Appendix C** includes the COC forms and analytical results for the IDW soil sampling.

2.3 Data Validation and Evaluation Activities

Upon collection of field data and receipt of analytical results from each laboratory, the data were validated, and incorporated into the existing database for the GWP site. The data validation efforts included an evaluation of the usability of the data as well as a comparison of ground water sample analytical results obtained using PDBs vs. the low-flow purge method. **Appendix G** includes a detailed description of the data validation activities.

2.4 Risk Assessment Activities

The BHHRA was performed to assess whether site-related contaminants pose a potential current or future risk to human health in the absence of remedial action. Shallow soil vapor data collected during November 2005 were used to evaluate risks through vapor intrusion into indoor air. These data were deemed appropriate for this purpose because they were representative of current site conditions and the sample locations were placed close to occupied buildings. Ground water data collected at the site since January 2004 were used in the BHHRA as a comprehensive and representative of current site conditions. Included in this assessment was an identification of chemicals of potential concern (COPCs), assessment of potential exposure pathways, assessment of contaminant toxicity, and risk characterization. This characterization provides a basis for determining whether remedial action is necessary at the site, identify which exposure pathways might warrant remediation, and provide justification for performance of remedial actions, as defined in the FS

Report (provided separately). The assessment was performed in accordance with planning documents, and the results are described in **Section 7**.

In addition to the BHHRA, a Tier 1 Ecological Checklist was prepared to characterize the ecological setting and to determine the existence of potentially complete and significant ecological exposure pathways. The checklist is described in **Section 7**.

2.5 Ground Water Modeling Activities

The JSP completed a draft ground water modeling report in March 2006. The ground water model was developed to evaluate the fate and transport of the GWP site contamination, to evaluate remedial alternatives for the site, and to assist in refining the site conceptual model in support of the GWP site RI/FS. Additional simulations were modeled to support the FS, and the modeling report was finalized. The modeling report entitled *Ground-Water-Flow and Solute-Transport Model for the Griggs and Walnut Superfund Site, Las Cruces, New Mexico* documents the results of the ground water modeling performed (**JSAI, 2006a**). Information contained in the modeling report that is pertinent to the RI/FS is summarized below.

The modeling report states that the regional ground water flow in the area of the site generally parallels the Rio Grande (ground water flows toward the southeast). Downward vertical flow gradients also exist within the aquifer, as documented at the site and at United States Geological Survey (USGS) nested wells in other portions of the Mesilla Basin. Locally, the ground water flow direction is influenced by boundary conditions such as irrigation works and municipal pumping. A west-to-east ground water flow direction exists at the site. The model indicates that this flow direction has likely been maintained in the area of the site for over the past 60 years (**JSAI, 2006a**).

A CSM was developed as part of the ground water modeling effort. The ground water model divides the aquifer at the GWP site into four layers, or zones (correlation between these layers and the UHZ and LHZ described in the RI is provided in **Section 3.7.2.4**). Most of the PCE contamination occurs in model layers 1 through 3. The CSM used in the model indicates that local recharge in the parks near the site and from storm water resulted in the migration of the PCE downward in the vadose zone to the ground water. Once in the ground water, the migration of the dissolved PCE was controlled by pumping at the CLC municipal supply wells (**JSAI, 2006a**).

The results of the modeling indicate that a ground water cone-of-depression currently exists south of the site and centered at CLC Well No. 24. The model results show that the cone-of-depression has resulted in a southeasterly ground water flow direction at the site. Finally, the model predicts that the

PCE plume at the site will migrate over time to the southeast towards CLC Wells 20, 26, and 24. Based on current pumping at the CLC municipal supply wells, the model predicts that the PCE will migrate past CLC Well 26 and towards CLC Well 24 after 30 years (**JSAI, 2006a**).